

Health Guidance:

Tick-borne Illnesses in Missouri

June 30, 2017

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SUBJECT: **Tick-borne Illnesses in Missouri**

Summary

The Missouri Department of Health and Senior Services (DHSS) alerts health care providers that reports of many tick-borne illnesses are higher than normal in 2017. Each year, Missouri experiences a substantial disease burden due to a variety of tick-borne illnesses including tularemia, ehrlichiosis, and Rocky Mountain spotted fever (RMSF) and other spotted fevers. Other tick-borne illnesses have also been reported in Missouri, including Lyme disease and Heartland virus disease, but the number of cases identified for these diseases remains low.

Tick-borne Rickettsial Diseases (TBRD)

Ehrlichiosis and RMSF are transmitted primarily through the bites of the lone star and American dog tick, respectively. Tick-borne disease agents from the *Rickettsiales* order most frequently reported in Missouri are *Ehrlichia chaffeensis* (ehrlichiosis); *E. ewingii* (ehrlichiosis); and *Rickettsia rickettsii* and other *Rickettsia* species (RMSF and other spotted or eschar-associated illnesses).

In 2016, Missouri reported nearly 600 cases of TBRDs. As of June 24, 2017, reports of ehrlichiosis are 18% higher, on average, than the same period for the years 2012 through 2016. Reports in 2017 of Rocky Mountain and other spotted/eschar fevers are 90% higher than the same five-year time period.

TBRDs can cause acute illness similar in initial presentation to many viral and bacterial febrile infections. Peak transmission of these tick-borne agents can continue into early August. Active transmission in Missouri typically is observed from late March through early October. TBRDs can cause severe illness and death in otherwise healthy adults and children. Diagnosis and treatment of these illnesses must be made on the basis of clinical signs and symptoms, and can later be confirmed using molecular and serological laboratory tests.

The standard for diagnosis of rickettsial infection is to perform an immunoglobulin G (IgG) indirect immunofluorescence antibody assay (IFA) on paired acute and convalescent phase specimens taken 2 to 4 weeks apart. During the first week of illness, when most patients seek medical care, antibodies are unlikely to be elevated. As the illness progresses past 7 days, however, the sensitivity of the IFA IgG assay increases in tandem with pathogen-specific antibody production. Serologic confirmation of TBRD in patients with compatible clinical illness is determined by a four-fold or greater increase in IgG antibody titers. Because of its longevity and problems with cross-reaction, use of IgM antibody assays for TBRDs should not be used as a stand-alone method for diagnosis of these conditions.

Polymerase chain reaction (PCR) tests can be used to diagnose ehrlichiosis during acute illness. This test is less sensitive for detecting RMSF infection. While treatment should not be delayed, antibiotic use will reduce the sensitivity of PCR testing. To minimize the risk of obtaining false negatives, specimens should ideally be

collected prior to administration of doxycycline.

Delay in diagnosis and treatment is associated with more severe illness and death. Case fatality rates for immunocompromised patients are characteristically higher than rates reported for the general population. Care providers should include TBRD in the differential diagnosis of summertime febrile patients with known or potential tick exposure.

Tularemia

Tularemia is a highly infectious disease caused by *Francisella tularensis*. There are two subspecies known to cause human illness; *F. tularensis tularensis* (Type A) and *F. tularensis holarctica* (Type B). Both types have been isolated from Missouri patients; Type A typically presents with more virulence and commonly occurs naturally in rabbit and rodent populations. In addition to tick-bite transmission, tularemia can be contracted through other means, including ingestion of contaminated water and undercooked meat, inhalation of aerosolized soils or blood, and direct contact with mucous membranes and broken skin. As of June 24, 2017, reported tularemia cases in Missouri are 90% higher than the five-year median for years 2012 through 2016.

Depending on the type of exposure, symptoms of tularemia will vary but generally start out as a flu-like illness and lymphadenopathy. Fever, sometimes high, is likely to accompany all forms. Severity of illness among the different forms of tularemia can range from mild to life threatening.

Diagnosis of tularemia is often made using serological antibody tests such as an enzyme-linked immunosorbent assay (ELISA). Antibody tests are most useful in the second week of infection, but may detect antibodies sooner. Some cross-reactivity may occur with *Brucella* spp., *Legionella* spp., and *Yersinia* spp., usually at low titers. Tularemia can also be diagnosed using a PCR test, immunofluorescence, slide agglutination, or by isolating *F. tularensis* from blood, sputum, or other exudates.

Because the symptoms of tularemia can be easily mistaken for other illnesses, diagnosis can be challenging. Without treatment, the case fatality rate can be as high as 30%. Prompt treatment with antibiotics, either tetracyclines or quinolones, can reduce the likelihood of complications related to illness. With treatment, the case fatality rate falls to 1-3%.

Lyme disease

Lyme disease, caused by *Borrelia burgdorferi*, is the most common tick-borne disease in the United States. It is transmitted through the bite of the blacklegged tick. Most North American cases of Lyme disease occur in the northeastern, mid-Atlantic, and northcentral parts of the United States.

In 2016, Missouri reported 10 cases of Lyme disease that met the national reporting criteria. In Missouri, most reported cases have a travel history to a Lyme endemic area described above. Cases were most likely exposed during travel and became ill and were tested upon return. It is important to note that Lyme bacteria have never been isolated from any of Missouri's cases. As of June 24, 2017, reported cases are elevated compared to the five-year median, but many are still under investigation and may not meet national reporting criteria once investigation is complete.

In about 80% of Lyme disease patients, early symptoms include a "bull's eye" skin lesion, typically appearing at the site of a tick bite. This characteristic lesion is also called "erythema migrans" (EM). Some patients with EM also have flu-like symptoms, which can include headache, fatigue, arthralgias, and brief arthritis of <2 weeks duration. Patients treated with antibiotics in early *B. burgdorferi* infection

usually recover rapidly and completely. If Lyme disease is not treated, infection can spread to joints, the heart, and the nervous system.

Lyme disease diagnosis should be made using the two-tier reflex testing process on the same specimen. The first tier of the process is to conduct an enzyme immunoassay (EIA) or IFA, which are screening tests. If a screening test is negative, no further Lyme testing is recommended. If a screening test is equivocal or positive, then the second tier Western Blot testing should be done. Requesting a Western Blot without first doing a screening test increases the frequency of false positives and can lead to misdiagnosis and improper treatment for the patient.

Missouri public health surveillance data indicate that risk of locally-transmitted Lyme disease is low. In cases where presentation includes an EM lesion and other characteristic symptoms (headache, fatigue, arthralgias, and brief arthritis of <2 weeks duration) but no out-of-state travel history, the diagnostic uncertainty should be resolved using both acute-phase and convalescent-phase (i.e., 2 weeks after the acute-phase) serum samples tested using the 2-tier testing algorithm.

Heartland and Bourbon Viruses

In the last few years, two previously unknown viruses have been found in Missouri patients. There is evidence to suggest that both viruses are transmitted by the bite of an infected tick. DHSS is working with our partners at the Centers for Disease Control and Prevention (CDC) to gather more information about how people get infected, which types of ticks or other insects may carry the viruses, and how to prevent illness from occurring.

To date, more than 20 cases of Heartland virus disease have been identified in the Southeast and South Central United States (i.e., Missouri, Tennessee, and Oklahoma). There have been fewer cases of Bourbon virus disease identified, but the geographic distribution of those cases is similar to Heartland virus. At this time, it is unknown whether either of these viruses is found in other parts of the United States.

Case patients with Heartland or Bourbon virus disease identified to date have had a flu-like illness with high fever, fatigue, anorexia, and diarrhea. Patients were found to have leukopenia and thrombocytopenia on presentation to the hospital and later developed elevated liver transaminases. Several patients required hospitalization and some died due to their infection with either Heartland virus or Bourbon virus. Most deaths have been in persons who are older and/or have underlying medical conditions. The majority of patients with Heartland or Bourbon virus disease, however, have recovered.

CDC is conducting an investigation that provides diagnostic testing for Heartland and Bourbon virus infections in patients with a clinically compatible illness. Because the laboratory tests are investigational, however, consent is needed from a patient to allow testing to be performed. Any patient meeting the inclusion criteria is eligible for the study regardless of where they live or sought care.

For more information about obtaining testing for Heartland or Bourbon viruses, please call the Office of Veterinary Public Health at (573) 526-4780 during regular business hours, or call the Emergency Response Center (ERC) at (800) 392-0272 after regular hours or on weekends. All requests for testing will be evaluated by a DHSS or CDC epidemiologist.

Tick Bite Prevention

The best way to avoid getting a tick-borne disease is to prevent tick bites from occurring. Encourage patients to take the following steps to protect themselves and their families:

- Use an insect repellent on exposed skin that contains at least 20% DEET, picaridin, or IR3535. Protection time will depend upon the repellent ingredient and concentration. Repellent should always be applied according to package instructions.
- The American Academy of Pediatrics and CDC recommends use of insect repellent containing up to 30% DEET for infants over 2 months of age.
- Clothing and gear can be sprayed with a repellent product called permethrin. Items should be sprayed and allowed to dry completely before use. Permethrin-treated items will remain effective for multiple washings. Permethrin should only be applied to clothing or gear, not to skin.
- Wear light colored clothing to make it easier to spot ticks that are crawling up. When possible, tuck clothing in to prevent ticks from crawling under clothing and attaching to the skin.
- After spending time in tick infested areas, do a thorough check for ticks. Showering soon after coming indoors is also recommended to more easily locate crawling or attached ticks. Remove ticks as soon as possible.
- Clothing worn outdoors can be placed in a dryer on high heat for at least 10 minutes to kill any ticks on the clothing. If the clothing is damp, additional time may be needed. If clothing needs to be washed immediately, wash in hot water and then dry on high heat until no longer damp.

For More Information:

1. Biggs HM, Behravesh CB, Bradley KK, et al. *Diagnosis and Management of Tickborne Rickettsial Diseases: Rocky Mountain Spotted Fever and Other Spotted Fever Group Rickettsioses, Ehrlichioses, and Anaplasmosis — United States*. MMWR Recomm Rep 2016;65(No. RR-2):1–44. DOI: <http://dx.doi.org/10.15585/mmwr.rr6502a1>
2. Centers for Disease Control and Prevention. (2017). *Tickborne Diseases of the United States: A Reference Manual for Health Care Providers*. Fourth edition. Retrieved from <https://www.cdc.gov/lyme/resources/TickborneDiseases.pdf>.